Memo **Delivered via email**

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Date	January 8, 2010		C. Cahnovsky

Subject **Chemetco – Pilot Plant Treatability Study Processing of Metal Bearing Materials**

As a follow-up to the December 22, 2009 meeting Chris Cahnovsky (IEPA Regional Manager, Bureau of Land) had with Elliott Stegin, Steve Zuber and Gary Davis, this memorandum provides additional details regarding performance of the treatability study processing work that Industrial Asset Disposition (IAD) proposes to carry out at the Chemetco site within the former Brick Shop.

The on-site pilot demonstration plant will be used to obtain specific operational data regarding the various steps involved in the overall process of extracting metal from the metal bearing materials (as defined in the Interim Order Civil Nos. 00-670-DRH/00-677-DRH (consolidated), entered September 16, 2008) at the Chemetco facility.

Purpose

To assemble and operate a pilot-scale treatability demonstration plant in the Brick Shop to demonstrate viability of the metal bearing material processing technology. The treatability study will be limited to demonstrate two separate metals extraction processes in two separate intervals; a soluble process treatment train, and an insoluble process treatment train. The treatability work will enable collection of operational data to: verify technology viability, estimate metal recovery rates, and allow the technology to be scaled up to a larger capacity plant. The pilot plant will utilize the equipment left behind in the Brick shop by Metals Finance, along with the addition of other smaller tanks and miscellaneous equipment such as pumps, valves, an air compressor, hose, and piping.

Treatability Study Limitations and Pilot Plant Process Variables

This work can be considered a treatability study because no more than 1000 kilograms (kgs) of each type of metal bearing material present at the site will be processed during the study. Sample types will be based on particle size and gradation, location of metal bearing material on site, color, and former smelting process that created the specific metal bearing material (i.e., sludge versus slag).

The metal bearing materials to be studied will be obtained from various locations around the Chemetco site. Each sample that is being studied will be stored inside the Brick Shop during

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the actual processing work. The maximum amount of metal bearing material that would be treated in any one day will not exceed 250 kg, based upon a pre-slurry dry weight, although each batch sample prior to hydration will be limited to a volume of approximately 5-gallons (35 to 50 pounds).

Several variables can affect the percentage of metal bearing material recovered at each step of the process. Multiple iterations or batch tests will be performed as various input variables are modified to optimize processing conditions and recovery rates of metal bearing material. These variables include the following:

- Physical grain size of metal bearing material to be processed;
- Slurry water to solids ratio for input feed material;
- Concentration of proprietary solution added to each process tank;
- Chemical addition rate for each proprietary solution to each reaction tank;
- Residence time within each process tank after addition of the proprietary solutions;
- Percentages of target metals recovered at each step;
- Volume or quantity of initial sample material and residual by-products after completion of metals recovery.

Preparation of Brick Shop

The Brick Shop contained former Chemetco smelter equipment used in processing and handling of liquid metals (steel troughs lined with refractory brick stored on shelves along west interior wall), and processing and testing equipment. All former Chemetco related equipment has been removed from the shop and set aside for handling/recycling during the pending building demolition work. Other former Metals Finance equipment will be temporarily removed and stored in the west end of the Tank House. Once these materials and equipment have been removed from the Brick Shop, the walls and floors will be swept and vacuumed to prepare the building for subsequent pilot testing use during the processing of metal bearing materials present on site. All interior building cleaning residuals will be collected and contained within drums and labeled accordingly.

Equipment, Materials and Personnel

As previously mentioned the existing equipment in the Brick Shop will be used to perform the treatability work. Several small additional processing tanks and equipment will be added to facilitate material handling needs during the multiple steps necessary in the processing sequence. Table 1 summarizes the equipment to be used during the pilot study.

Small quantities of one percent sulfuric acid will be necessary to initiate the processing reaction. It is anticipated that no more than 50 gallons of sulfuric acid will be stored for use in the Brick Shop at any one time during performance of the pilot treatability study. Additional solutions to be used in subsequent reaction steps are non-toxic, but are proprietary and cannot be disclosed at this time. Chemicals will be stored in labeled drums, plastic containers or jugs, and placed within secondary containment platforms.

Dr. Michael Smallwood will operate the pilot plant with support from Christopher Smallwood. Both individuals have been involved with the development of the proprietary technology to be employed by IAD, and have also performed the previous bench scale work. Estate personnel will move former smelter equipment out of the Brick Shop and also assist with sample collection and transport of small quantities of metal bearing material from existing storage areas to the Brick Shop for processing and testing.

Treatability Processing and Material Handling

Existing metal bearing material that is intended for treatability processing will be obtained from current storage areas, including but not limited to, the Receiving Building, DIS Building, Dome Building, various stockpiles on site, and the floors of both the Tank House and the Foundry Building. Metal bearing material will be transferred to the Brick Shop in approximately 20 to 25 kg batch quantities. Storage vessels for the batch samples will be labeled with sample number, location obtained on site, and date the material was entered into the initial slurry feed tank for metals recovery processing.

Initial testing will be performed on the finer-grained scrubber sludge. The batch sample will initially be screened to remove deleterious materials, then any clumps or clods of sludge will be broken up manually with a pestal and mortar or equivalent prior to screening through a No. 80-mesh (0.177mm) brass sieve. Waste, non-metal bearing materials, debris or reject material screened from metal bearing material will be containerized in a drum labeled “screening debris.” Screened batches of metal bearing material passing the No. 80 mesh (0.177mm) will then be weighed to obtain the mass of the actual sample prior to the addition of slurry make-up water (hydration). Figure 1 contains a process flow diagram that summarizes initial sample collection and preparation.

During treatability processing, slurried scrubber sludge will be fed sequentially into a series of aboveground tanks and treated with proprietary solutions with metal isolation or recovery occurring at each intermediate step. Metal solids will be recovered and dewatered in a small filter press with residual water solutions returned to the previous tank to be used in subsequent processing steps. Figure 2 contains a process flow diagram that details the sequence of steps associated with the pilot-scale treatability study. Table 2 contains a summary of the steps to be performed and the metals to be recovered during the pilot study.

Upon completion of processing, recovered metals will be weighed to determine the mass of recovered metals then submitted to a third party analytical testing laboratory for purposes of metals characterization. Any residual by-products that will not undergo further metals processing will be drummed, labeled and appropriately disposed of off-site within 90 days from initiation of processing of that particular sample batch. Representative samples of residual by-products will be submitted to a third party analytical testing laboratory for Total Metals and TCLP analysis. Residual processed materials or screening debris that do not pass EPA TCLP testing will be labeled as hazardous, drummed accordingly and disposed of off-site within ninety days of generation.

Schedule

The pilot demonstration plant will be assembled within the Brick Shop and ready to operate by January 22, 2010.

Once the pilot demonstration plant has operated for several weeks and treatability data is obtained for several batch samples, results will be compiled into a Pilot Study Demonstration Summary Report and provided to IEPA. This data will also be included in the Scrubber Sludge Processing Work Plan that is currently under preparation.

With Pilot processing data in hand, IAD will begin to increase throughput within the pilot demonstration plant working toward a 250 kg per day processing rate. This information will be beneficial in subsequent processing scale-up and to support full-scale design efforts.

TABLE 1

Pilot Plant Equipment List

Pilot Treatability Study Demonstration
Former Chemetco Site - Hartford, IL

Equipment Type	Quantity	Size or Capacity	Auxilliary Equipment	Material	Manufacturer, model number (if available)	Description
Mixing Tank System	1	dual 30-gallon conical bottom poly tanks	dual diaphram pneumatic driven transfer pumps, monel injection pumps, shaft driven agitation/mixing equipment	plastic tanks, various metal pumps and mixing equipment	Not Available	Single unit consisting of support frame housing mixing tanks and auxilliary equipment
Containment/ Spill Pans	6	4 ft x 8 ft x 6 in	none	plastic	Not Available	Containment pans for any spillage resulting from "wet works" processes
Poly Tanks	6	150-gallon capacity	none	plastic	Barr Plastics	Tanks 1B, 1C, 1D, 2B, 2C, 2D (see Figure 2)
Solvent Extraction Unit	1	See description	See description	Inert	Vancouver Industrial Electric, model P.D. APP-SX	Single unit consisting of several low-profile poly containers with inlet and outlet ports. Semi-effective weired separation unit. May be used as a separation unit or for chemical injection
Electro-Twinning Unit	1	See description	See description		Vancouver Industrial Electric, model P.D. APP-EH	Single unit to function as electro-coagulation processing step
AC/DC Power Converter	1	unknown	none	metal	Rectifiers and Plating Co., model 2_RDDS-SC012-02	DC power supply for conversion of AC supply power
Granulator	1	unknown	none	unknown	IMS Company/Beldon Corp., 2049 SPO	Mill grinder for use in feedstock sizing
Step Down Transformer	1	15kVa, 3 phase	none	steel	General Electric, 9T23B3881	Step-down transformer from high to low voltage
Oven/Kiln	1	120 V	none	unknown	Barnstead/Thermolyne, OV35135	High temperature oven/kiln
Shaker Screen System	1	unknown	vibration base	unknown	Fisher Scientific Co	for use in size separation of particles
Filter Press Unit	1	1 cubic ft	none	steel	Met-Chem/ 1618	
Compressor	1	220 psi	none	steel	Gardner Denver/ 32ADD645	air supply to various equipment
Drum Head Vacuum Unit	1	unknown	unknown	unknown	Not Available	
Poly Tote Containers	4	250-gallon	none	plastic	Not Available	used to store various process materials
Poly Tanks	2	150-gallon	none	plastic	Not Available	
Poly Tanks	unknown	30-gallon	none	plastic	Not Available	Specialty tanks with conical bottoms. Independent units

ft = feet
in = inches
kVa = kilo-volt ampere
V = volts
psi = pounds per square inch

TABLE 2

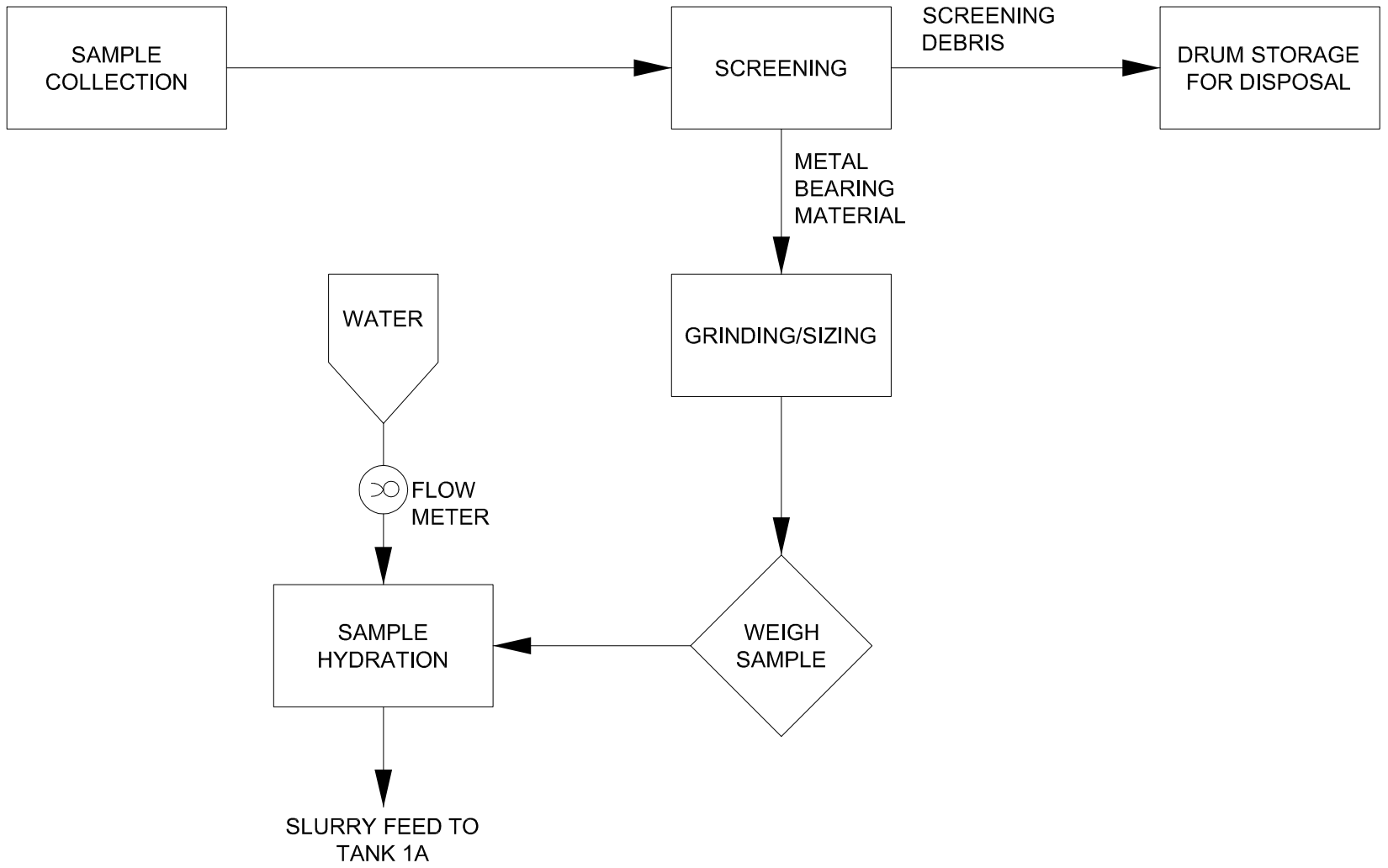
Summary of Pilot Plant Processing Steps

Pilot Treatability Study Demonstration
Former Chemetco Site - Hartford, Illinois

Step	Purpose	Type	Action	Elements Solubolized	Elements Recovered
--	Comminution	Physical Sorting	Crushing/Grinding	--	--
--	Size Separation	Particle Sizing	Screening and Classification	--	--
--	Unification Process	Hydration	Create liquid/solids slurry	--	--
Tank 1A	Minerals Beneficiation	Separation and Concentration, Hydrochemical Reaction 1, 1% sulfuric acid addition, "reducing agent"	Generation of Soluble and Insoluble Feedstock, Segregation of Soluble and Insoluble Feedstock, Transfer of Soluble and Insoluble Feedstocks, Collection of Carbon Float	Ni, S, Ca, Sn, Si, Cu	C
Tank 1B	Minerals Beneficiation	Separation and Concentration	Receive Raw Carbon Float from Feedstock Tank 1, Recovery of Activiated Carbon, Transfer of Process Water for Recycle	--	C
Tank 1C	Minerals Beneficiation	Separation and Concentration, Hydrochemical Reaction 2	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	CaS, NiS
Tank 1D	Minerals Beneficiation	Separation and Concentration, Hydrochemical Reaction 3, Add Proprietary Chemical	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	Sn, Cu
Tank 2A	Minerals Beneficiation	Separation and Concentration	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	Mg, Mn, K, Na	--
Tank 2B	Minerals Beneficiation	Separation and Concentration	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	--
Tank 2C	Minerals Beneficiation	Separation and Concentration	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	--
Tank 2D	Minerals Beneficiation	Separation and Concentration	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	--
EC 1, 2, 3	Minerals Beneficiation	Electro-Coagulation, Heavy Density Elements	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	Cd, Fe, Pb
EC 4, 5, 6	Minerals Beneficiation	Electro-Coagulation, Light Density Elements	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	Al, Sn, Zn
EC 7, 8, 9	Minerals Beneficiation	Electro-Coagulation, Copper Groups	add proprietary chemical, phase separation, phase recovery, transfer of process water for recycle and conditioning	--	Cu, Zn
--	Polishing	--	Further Refinement, Recycling	--	--
--	Water Quality and Recyle	Water Handling, Water Filtration	Water Conditioning, Recycle	--	--

-- = not appplicable

Plot Date: 01/11/10 - 9:42am, Plotted by: bernadette.pastrana
Drawing Path: Y:\15210.000.0\eng\, Drawing Name: _TB-process_flow.dwg



CAUTION: THIS PLAN MAY BE REDUCED 0 1" 2" ORIGINAL SCALE

REFERENCES:
PLANS
DATUM

NO.	REVISION	DATE	APRVD

DRAWN BRP
DESIGNED BS
CHECKED --
REVIEWED --

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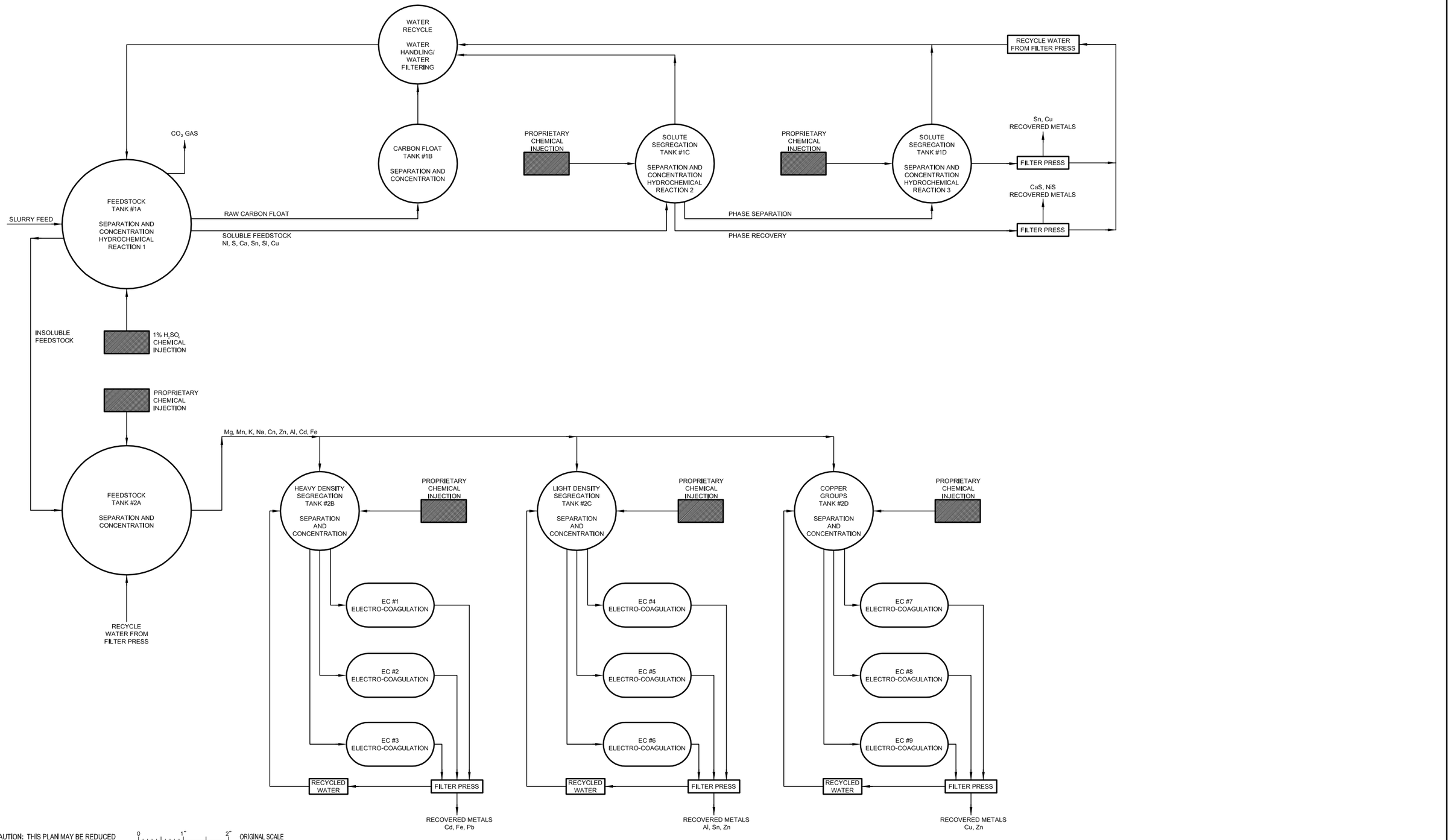
SLAG AND SCRUBBER SLUDGE METALS RECYCLING
FORMER CHEMETCO SITE
HARTFORD, ILLINOIS

TREATABILITY SAMPLE PREPARATION

DATE: 01/11/10
SCALE: NTS
SHEET: 1 OF 2 SHEETS
PROJ No: 15210.000.0
1



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REFERENCES:	NO.	REVISION	DATE	APRVD
PLANS				
DATUM				

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SLAG AND SCRUBBER SLUDGE METALS RECYCLING
FORMER CHEMETCO SITE
HARTFORD, ILLINOIS

PILOT PLANT
PROCESS FLOW DIAGRAM

DATE: 01/11/10
SCALE: NTS
SHEET: 2 OF 2 SHEETS
PROJ No: 15210.000.0
2